POLYPLOIDY IN ECHINOCYSTIS

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During the course of a survey of wild and cultivated species of the Cucurbitaceae to determine the host range of the cantaloupe mosaic virus, I have had an opportunity to study at first hand living material of a great many species of this interesting and diverse family. In conjunction with the mosaic studies, cytological investigations were initiated, and a technique was developed to study the chromosomes by modern methods. As an incidental part of the latter investigation, I had occasion to examine *Echinocystis macrocarpa* Greene, the chilicothe or mock-cucumber native to coastal California from Monterey Bay southward to Lower California, Mexico.

McKay (1931) studied *Echinocystis macrocarpa* and two other West Coast species (*E. fabacea* Naud. and *E. oregana* Cogn.) and reported that each species has 16 pairs of chromosomes. *Echinocystis lobata* T. & G., a species of the eastern United States, is apparently a diploid, since it was reported by Kirkwood (1907) to have sixteen pairs of chromosomes.

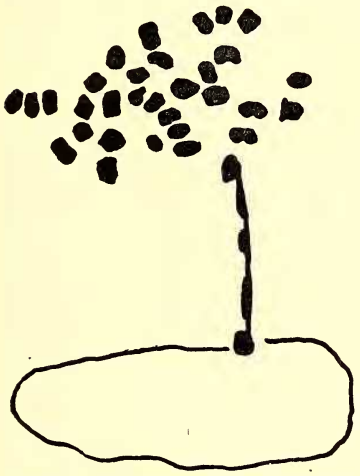

Fig. 1. *Echinocystis macrocarpa:* late anaphase showing 32 chromosomes; note chromatin bridge. Lower grouping shown only in outline. ×2400.

Plants of *Echinocystis macrocarpa* that I have sampled in San Diego County, California, have thirty-two gametic chromosomes (fig. 1). Evidently, they are tetraploid. Meiosis is characterized by an occasional multivalent and chromosome bridge; otherwise, the meiotic divisions are perfectly normal. In lactophenol the stainable pollen averages about 97 per cent. These observations argue against the possibility of this material of *E. macrocarpa* being a recent autopolyploid. Specimens on which these counts are based have been deposited in the Herbarium of the University of California, Berkeley, California.

There is some supporting evidence from morphological characters for the tetraploid nature of *Echinocystis macrocarpa.* The fruits and seeds in particular exhibit "gigas" characters. The fruits are normally three to six inches long and two to three inches in diameter, considerably larger than the fruits of other species

of *Echinocystis* in the Pacific Coast area. The contrast in seed size is not so great as that found in the fruit; nevertheless, the average size of seed is apt to be larger in this species.

The discovery of a naturally occurring, numerical polyploid in the Cucurbitaceae is of unusual significance. Numerical polyploids are exceptionally rare in this family and have been found in only one other genus, *Trichosanthes,* although fifteen or more genera have been studied cytologically. Nakajima (1937) reports that the dioecious species *T. cucumeriodes* Maxim. has twenty-two pairs of chromosomes, whereas *T. japonica,* also dioecious, has only eleven pairs.

The above facts suggest that evolution at the species level in the Cucurbitaceae has proceeded for the most part by genic differentiation. For example, in the relatively large and greatly diversified genus *Cucurbita,* evidence from species crosses (Whitaker, unpublished) indicates that the difference between some of the species is dependent upon a comparatively small number of single gene mutations. Thus, it seems safe to conclude that evolution in this large and diverse family has proceeded mostly by genic differentiation (at the species level), supplemented by the infrequent occurrence of polyploidy.

Bhaduri and Bose (1947) have interpreted their observations to mean that increase in chromosome number in this family is primarily due to allopolyploidy, combined with fragmentation of chromosomes at particular loci. Their evidence is largely indirect, and, in any event, does not provide a critical test for their assumptions. However, these suggestions are stimulating and subject to experimental attack. By the use of colchicine and modern cytological methods, it should be possible to obtain some insight into the question of fragmentation. The most favorable genus for this work would undoubtedly be *Cucumis,* where *C. sativa,* the cucumber, has seven pairs of chromosomes, and the remaining species are reported to have eleven and twelve pairs.

To summarize, the discovery of a natural, numerical polyploid in the Cucurbitaceae is of some biological significance for several reasons. First, it indicates that polyploidy may have had an important role in the evolutionary development of certain genera in the family. Second, it tends to harmonize the evolutionary pattern in the Cucurbitaceae with that found in other dicotyledonous families.

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IRA WADDELL CLOKEY

The death of Ira Waddell Clokey at his home in South Pasadena, California, on January 13, 1950, marks the passing of a man whose career was extraordinarily useful to the science of botany even though botany was but an avocation with him. Born at Decatur, Illinois, on December 21, 1878, Ira Clokey was the son of Josiah Mitchell Clokey and Susan Carrie Elson. He attended the University of Illinois and Harvard University, receiving from the latter in 1903 the degree of Bachelor of Science *cum laude* with a major in mining engineering, a profession which he followed until 1920, when he entered Iowa State University to specialize in botany. He received the degree of Master of Science in Plant Pathology from this institution in 1921.

As a boy, Ira Clokey showed an avid interest in botany and this interest remained with him as long as he lived. In Decatur High School, one of his classmates was H. A. Gleason, and together they went on many a trip to collect and study the flora of Illinois. His career as a mining engineer took him in 1904 to Mexico, where he remained for seven years, and in 1915 to Colorado. In both regions he collected extensively, and built up a herbarium containing an excellent representation of the plants of each area. Unfortunately, in 1912, his herbarium, containing all of his Mexican collections and some of his early Illinois material was destroyed by fire. The fact that the duplicates of his Mexican collections had never been distributed, is a great loss to science. His later collecting was pursued with a view to rebuilding his herbarium through exchange. With this end in mind, he collected many duplicates, and as a result, there are few herbaria in the world that do not have representatives of his collections. Despite his having collected in large quantities, his specimens were beautifully prepared.

Mr. Clokey's early interest in botany centered around the genus *Carex* and he carried on extensive correspondence and exchange with several of the caricologists of the early part of the current century. As a result of these early exchanges, much of the classical material of the genus *Carex* is in his herbarium.

In 1935 Mr. Clokey became interested in the flora of the mountains of the southwestern United States and selected the Charleston Mountains of southern Nevada for intensive study. Here he collected large sets and it may be said that through his